Recent 35t Noise Tests

20160511 - 35t

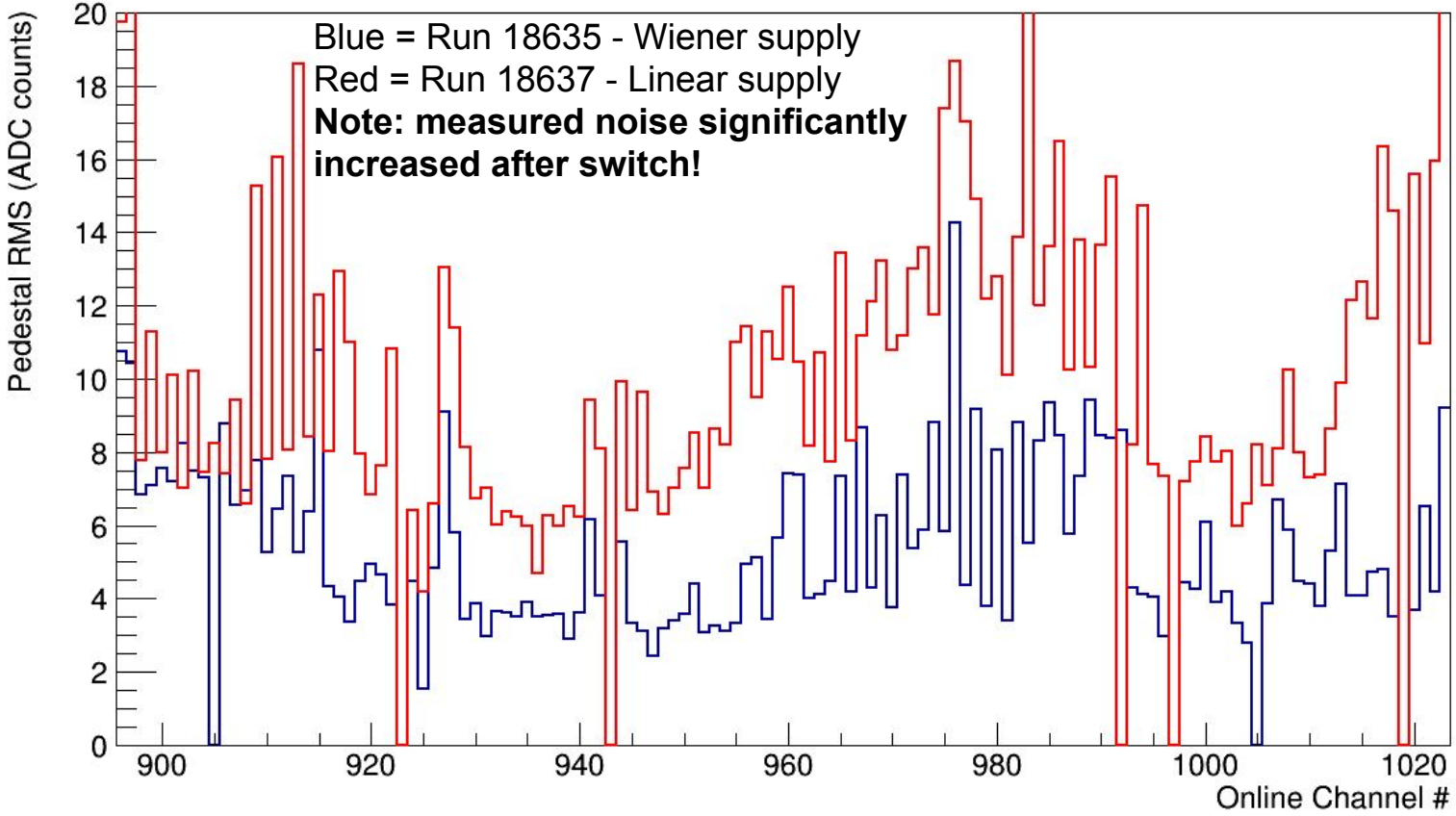
Recent Noise Tests

- Switching LV power to linear supply (check Wiener crate as a noise source)
- Spectrum analyzer measurements
- Disabling ADC sampling on subset of channels, check noise on remainder
- Recent observation: SSP noise highly correlated with TPC status

Linear LV Supply Test

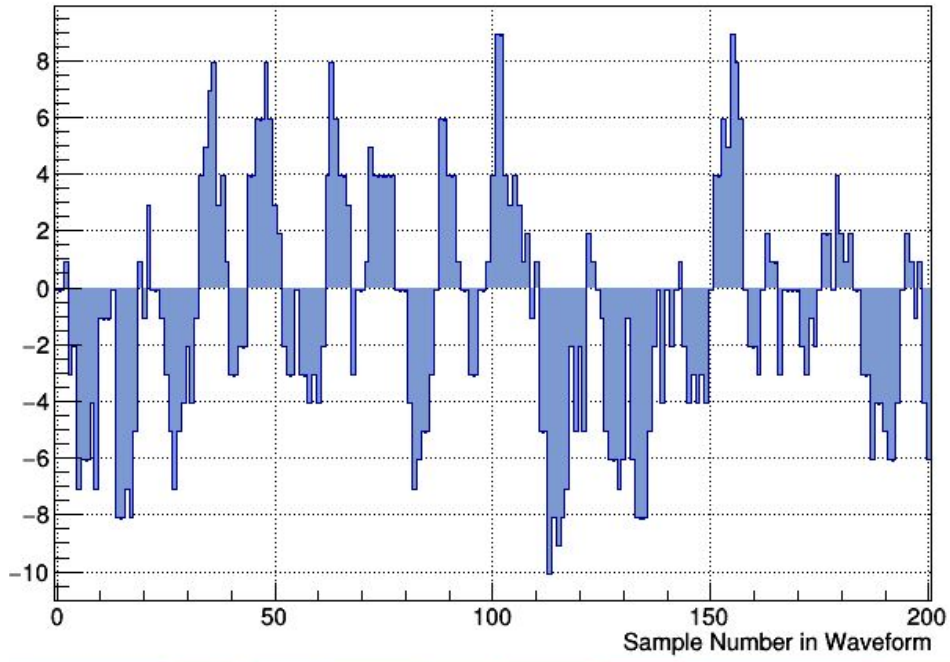
- Goal: check if Wiener LV supply is a noise source
  - First FEMB07 connected to linear supply, other FEMBs completely off
  - Later optical card power switched to linear supply as of run 18638
- Note: low voltage ASIC power had to be adjusted to remove the low-frequency correlated component after switching to the linear supply

Pedestal RMS Vs Chan Comparison

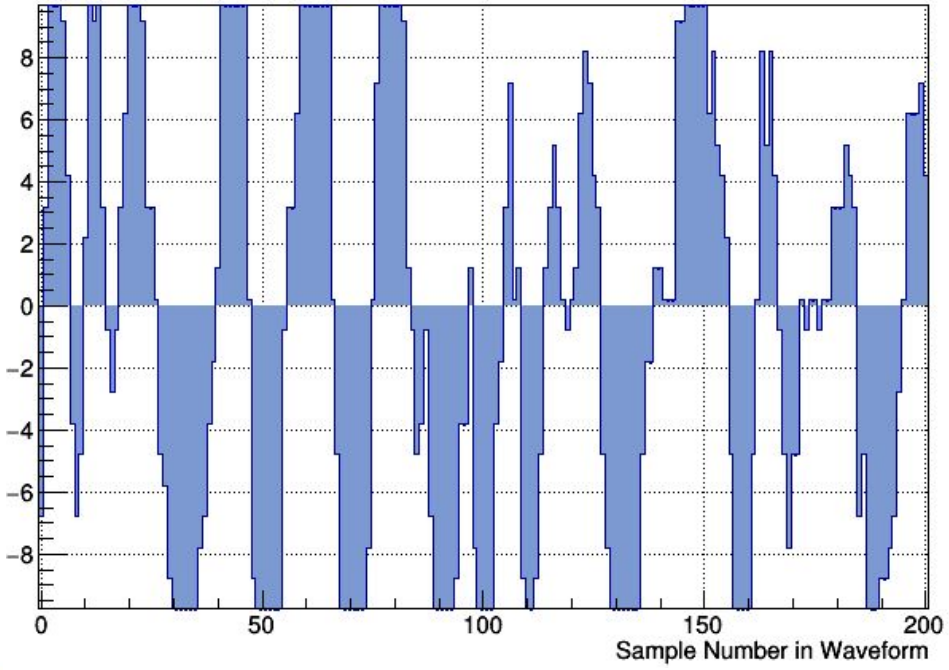


Waveform Comparisons Before/After Switch

Run 18635 - Wiener

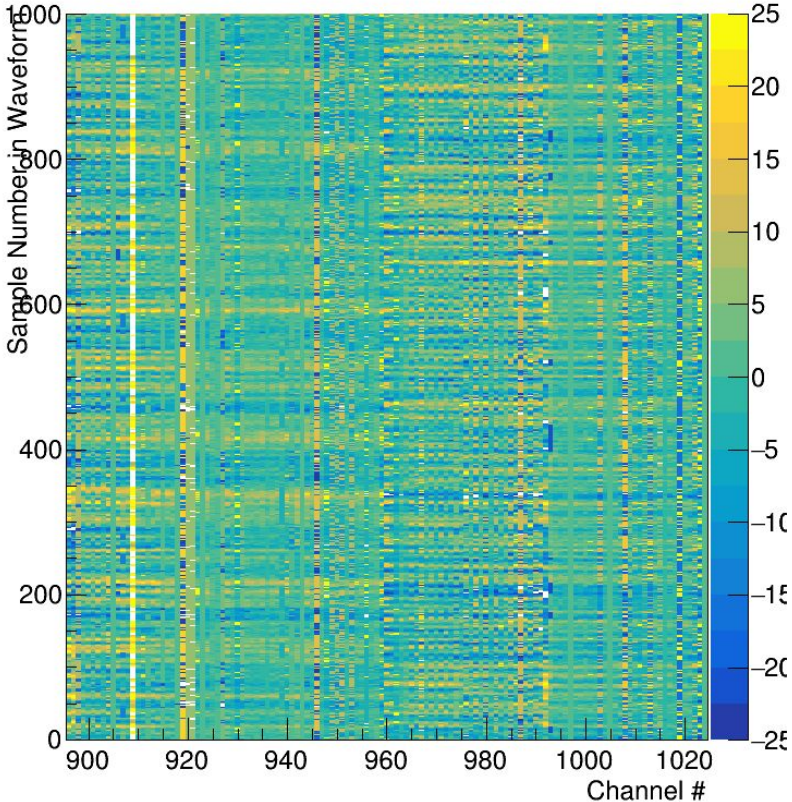


Run 18637 - Linear 2.2V

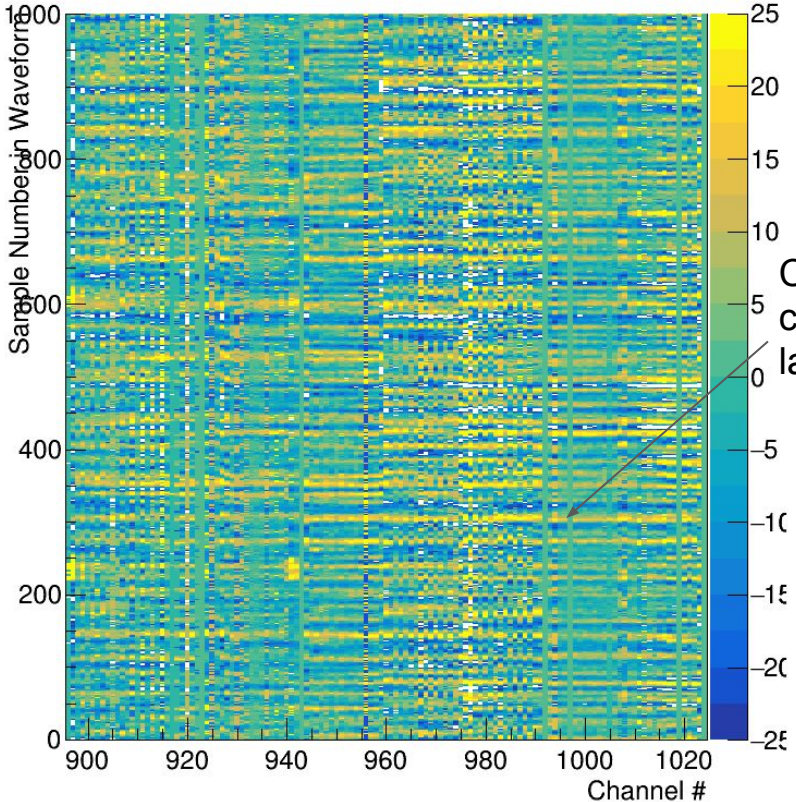


Waveform Vs Chan Comparison Before/After Linear

Run 18635 - Wiener

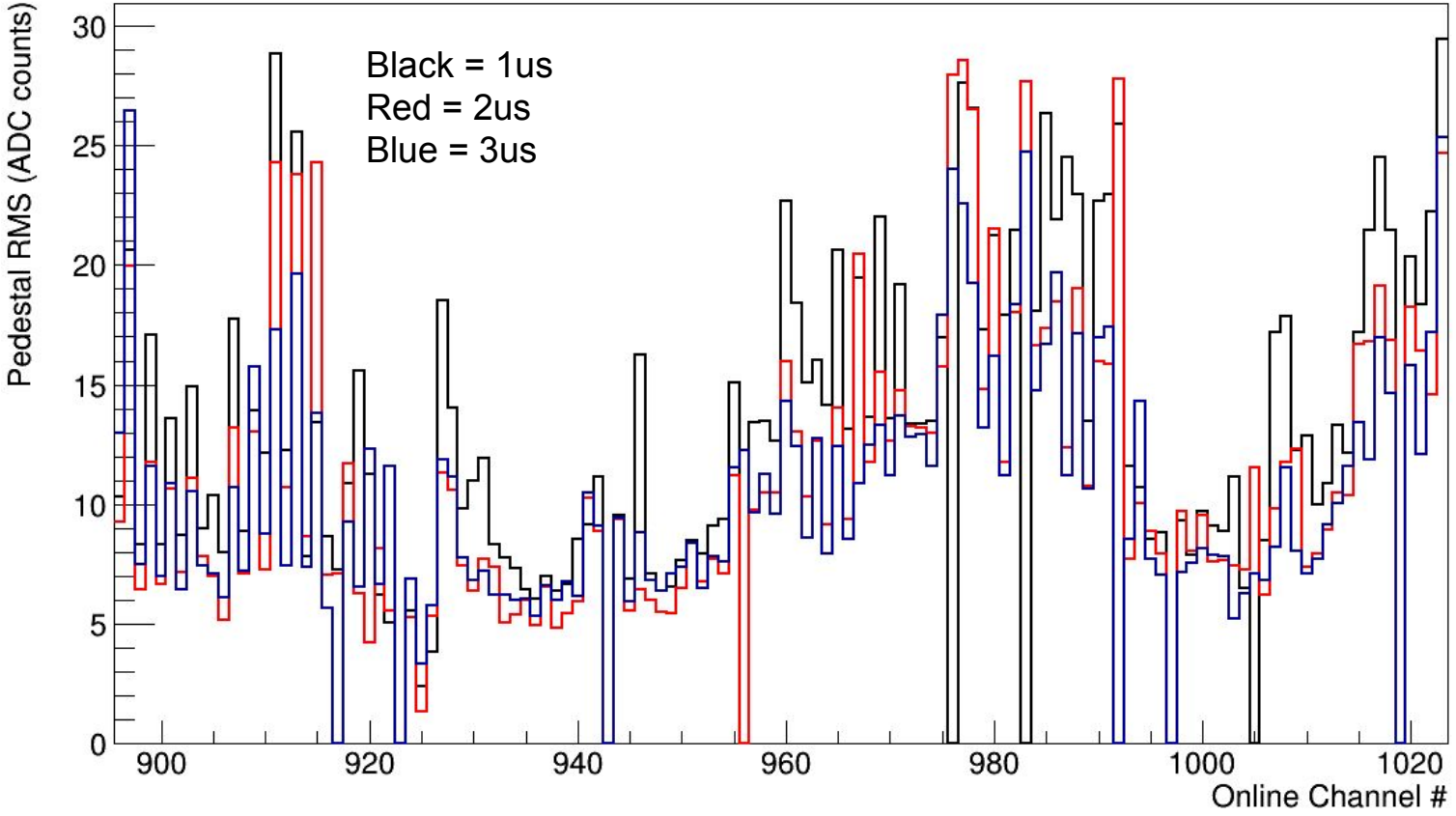


Run 18637 - Linear 2.2V



Correlated components larger after switch

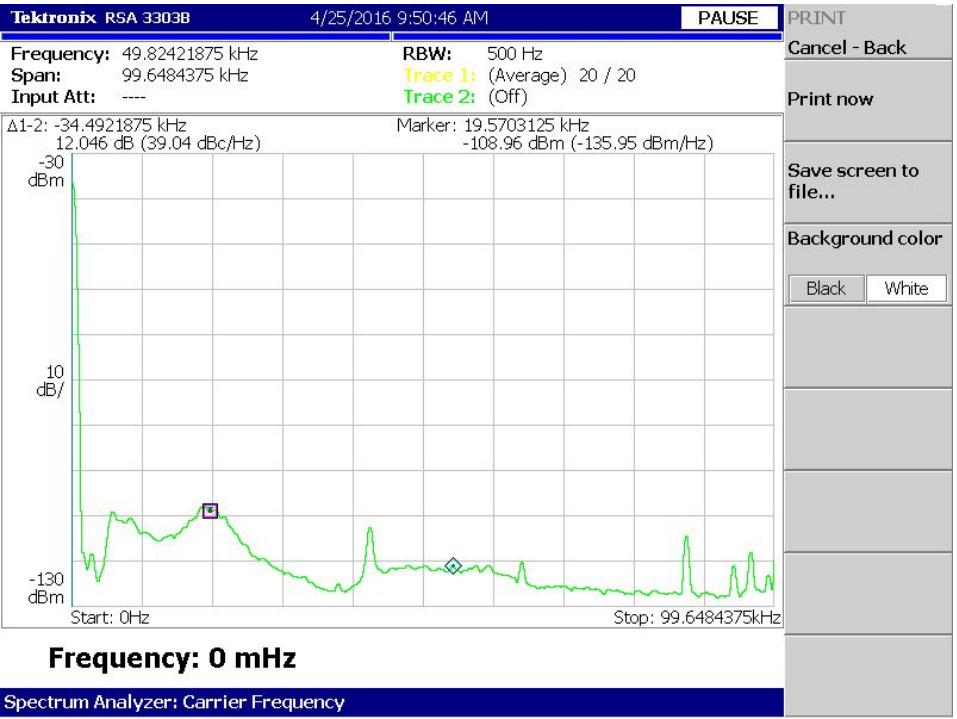
FE-ASIC Shaping Time Scan with Linear Supply



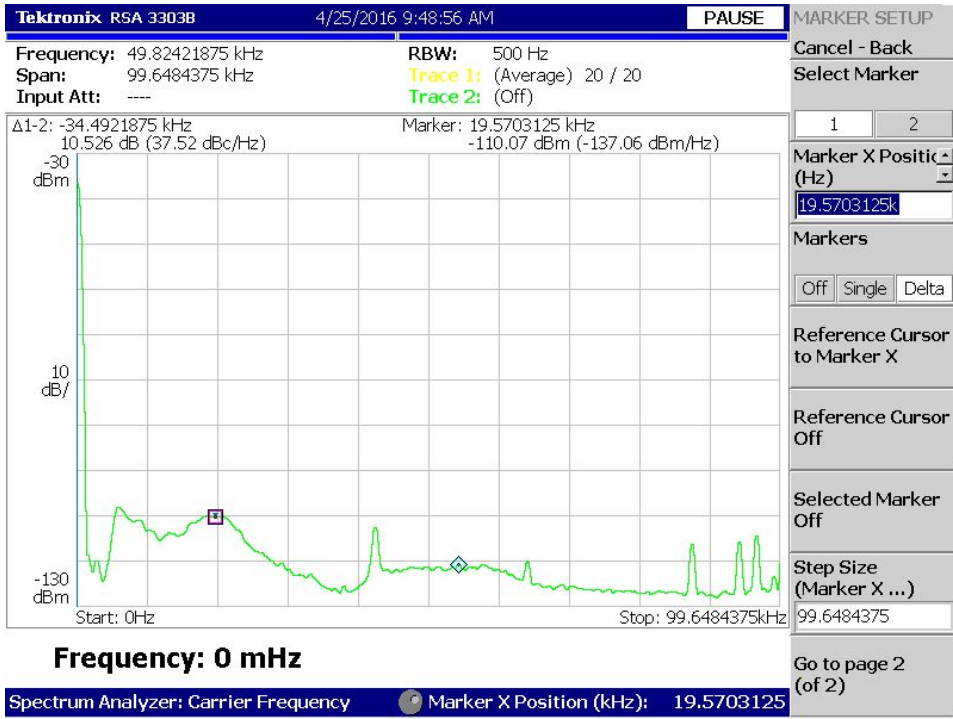
Spectrum Analyzer Measurements

Spectrum analyzer connected to 4-boar APA grid, FEMB07 on this APA

Linear Voltage to ASICs = 2.2V

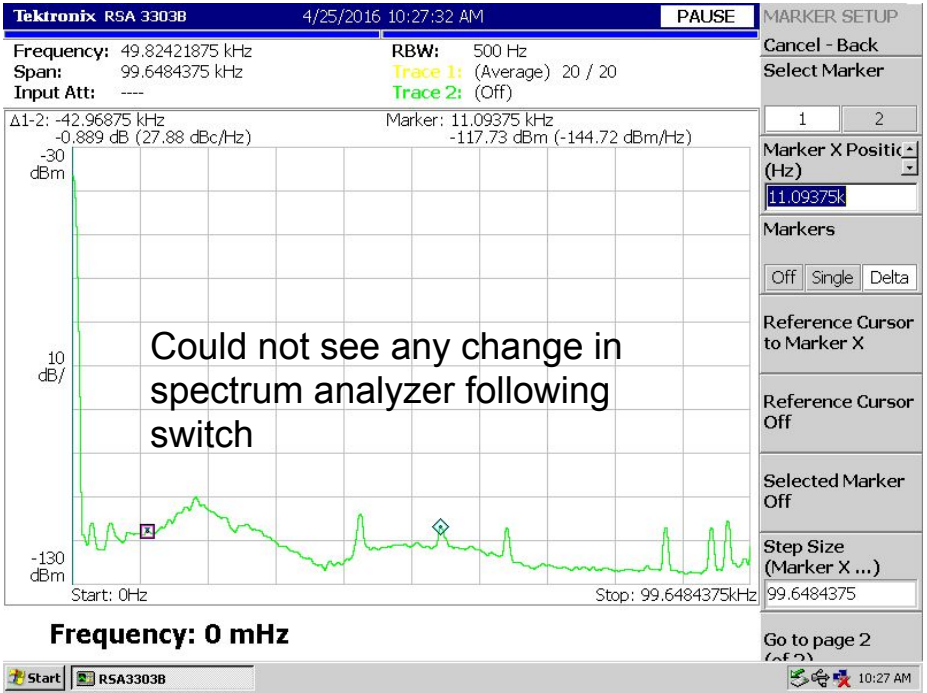


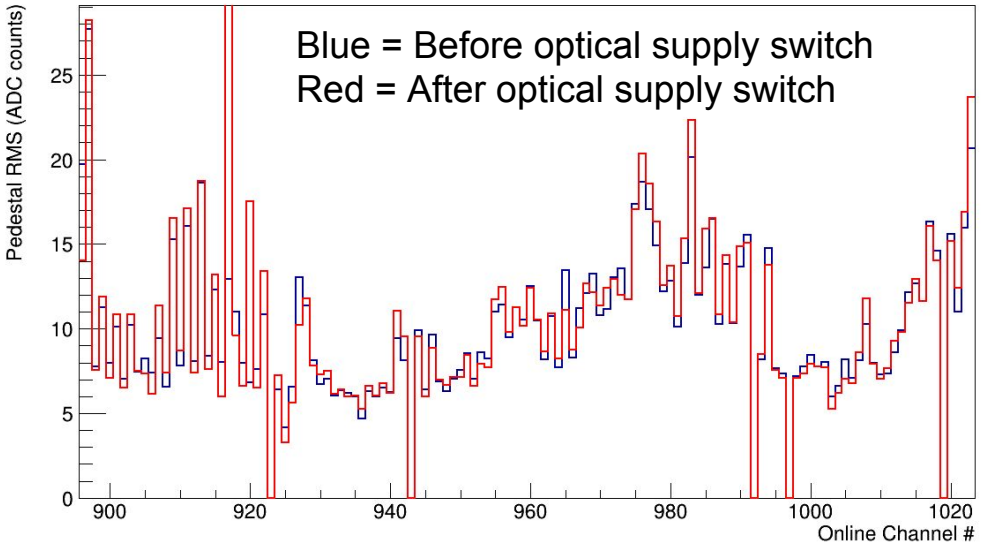
Linear Voltage to ASICs = 2.4V



Optical Board Power Switched to Linear Supply

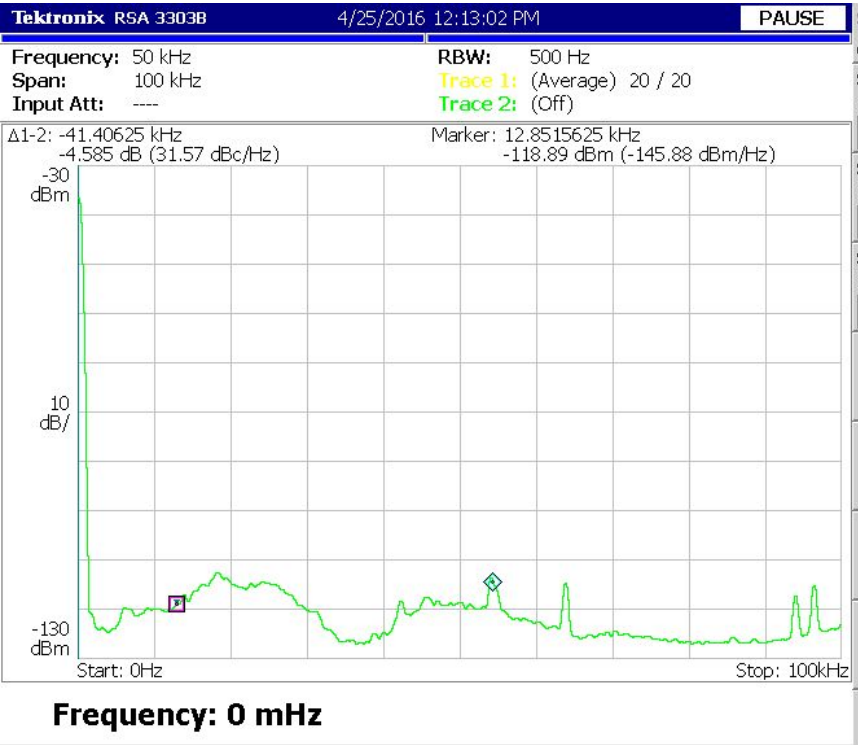
- Capped all the unused lv cable ports and wire bias SHV
- Optical board is running with a floating supply (optical board ground referenced to detector)
- FEMB07 running with floating LV supplies, ASIC supply voltage = 2.2V
    - Filter capacitors referenced to detector as the power goes through the Flange.



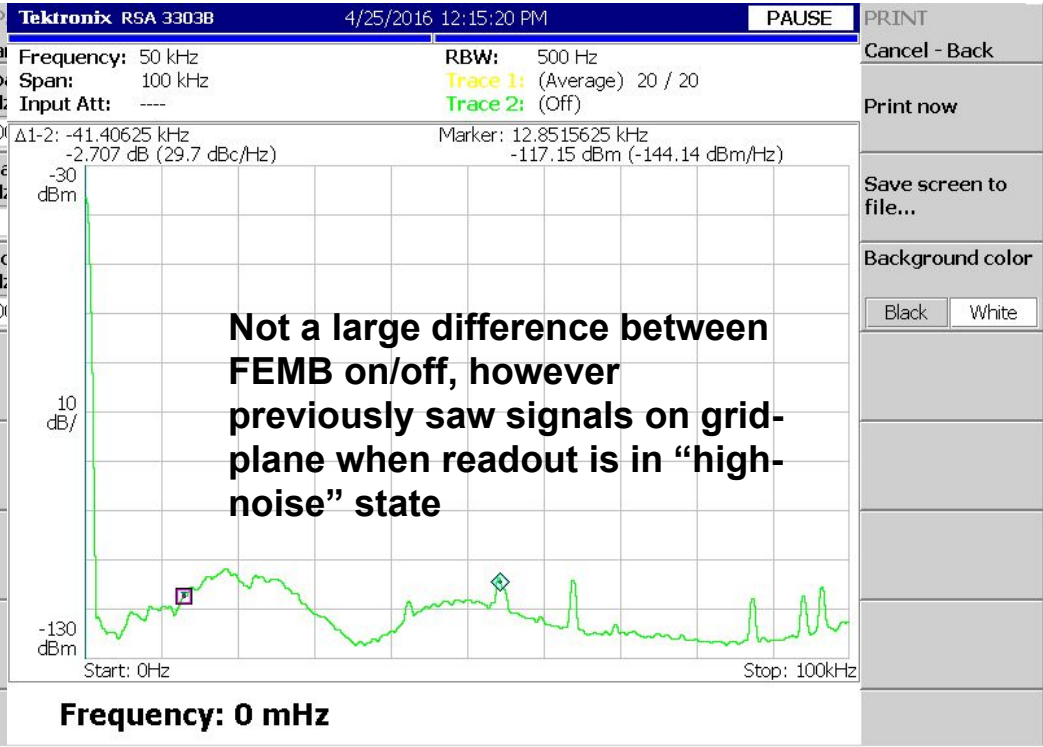


Spectrum Analyzer on Grid Plane - FEMB07 On/Off

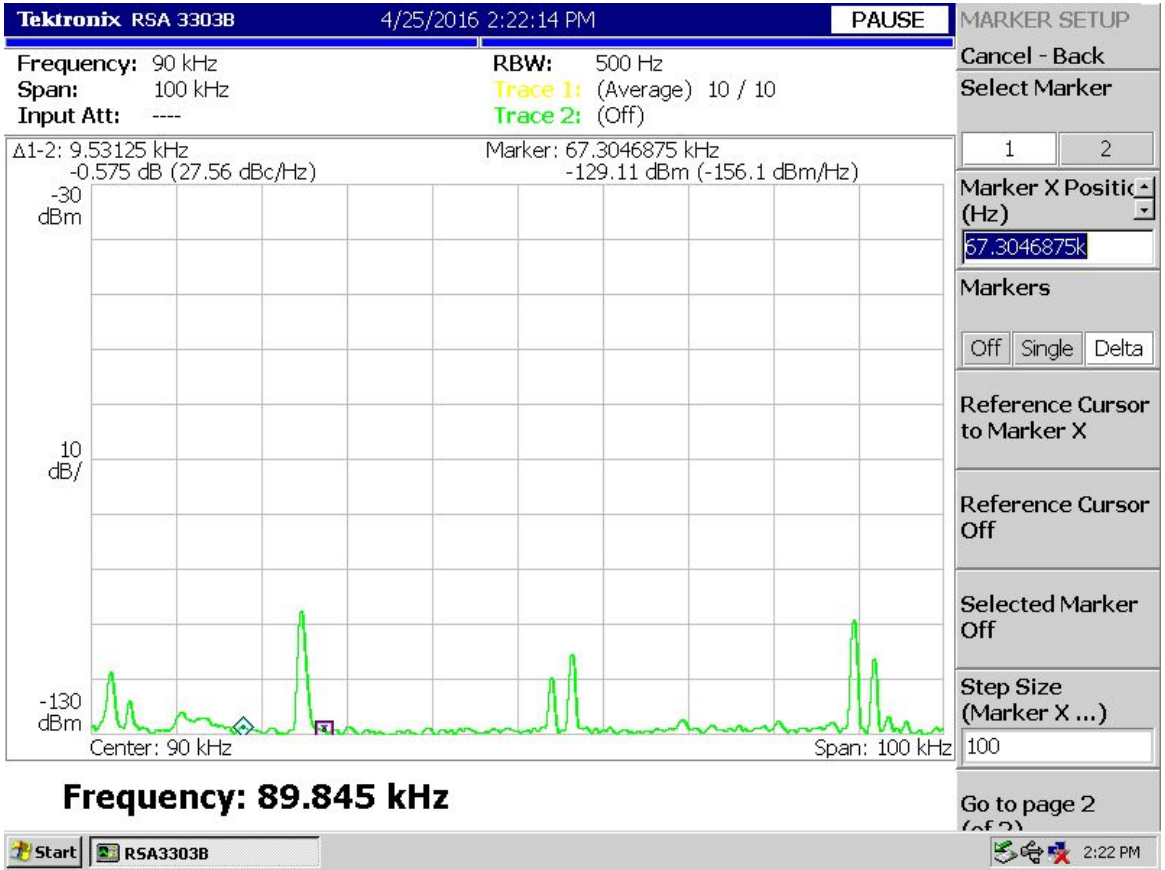
FEMB07 ON



FEMB07 Off



Spectrum Analyzer on Metal > 30ft from Cryostat



ADC Sampling Test

- Disabled ADC sampling on subset of ASIC channels with single board readout
  - Noise levels for ASIC channels left on did not change significantly (plots incoming)
  - Agrees with test stand observations
  - Note previous measurements also showed that turning off FEMB FPGAs/digital logic does not reduce noise on remaining FEMBs

SSP Noise Correlated with TPC Status

- Verbal update from Gary Drake at today's 35t meeting:
  - SSP noise increases when FEMBs are turned on
  - SSP noise increases significantly when FEMBs start taking data (x5?)
  - Unclear if this occurred before detector was filled
- 35t operational experience:
  - When TPC readout went into high noise state, DAQ would often crash immediately
  - Determined that SSPs trigger rate increased enough to end run
- TPC channel noise measurements:
  - Observed small (~100-200e-) increase in noise when SSPs turned on

Reminder: Bad Channel Summary

- Three main sources of FEMB channel failure after installation:
  - Corrupted data on FEMB03 ASICs 0-3, FEMB14 ASICs 0-3, likely due to a signal disconnection between FPGA and ADC ASICs (ie. mechanical connection failure)
  - FEMB09, FEMB10 LV power cables seem to have developed a short on cold side
  - 7 bad ASICs following cryogenic power cycle (try running at 900mV baseline)
- Total number of bad channels = 550
  - Includes individual bad channels, does NOT include broken wires
- This does not include APA3 ASICs having to be turned off to obtain stable operation
  - Increased time between high-noise states to >2 hours

Summary

- Increase in noise levels with linear supply is unexpected
  - Difficult to diagnose the cause, but suggests further tests of LV power cabling after the detector is warmed up
- Spectrum analyzer measurements didn’t find obvious FEMB-readout related noise on grid-plane with single-FEMB on
  - In contrast to previous observation of FEMB-related noise on grid-planes when system was in “high-noise” state
- Disabling ADC sampling does not seem to reduce measured noise